

those that “push” air through it. Therefore, some units have the HEPA filter upstream of the motor/blower assembly and others place the HEPA filter downstream of the motor/blower. The advantages and disadvantages of each design concept are summarized in **TABLE 6.2**.

Table 6.2 – Downstream/upstream HEPA filter locations in PHFS

(+) Advantages	(-) Disadvantages
Type A DOWNSTREAM HEPA	Type B UPSTREAM HEPA
(+) easier access to HEPA filter for scanning or leak testing	(-) difficult access to HEPA filter for scanning or leak testing
(+) easier to repair leaks in HEPA filter if allowed	(-) difficult to repair leaks in HEPA filter if allowed
(+) may not require mixing chamber to assure uniform mixing of test aerosol	(-) requires mixing chamber to assure uniform mixing of test aerosol
(-) motor/blower may become contaminated	(+) motor/blower should stay uncontaminated unless filter leaks
(-) cabinet interior may become contaminated	(+) cabinet should stay uncontaminated unless filter leaks

Design, materials, specifications, and quality of construction vary widely among PHFS. These variables have a tremendous impact on overall performance and effectiveness. In particular, the cabinet material must remain rigid and undistorted during shipping, handling, and the rigors of daily operation to prevent the contaminated air from bypassing the HEPA filter. The type and gauge of metal fabrication methods, braces, holes, cracks, fasteners, welds, gaskets, and seals must be designed, specified, and assembled with potential leakage, durability in service, and maintenance in mind.

[Note: Much of the above may not be applicable to units constructed and certified to ASME AG-1<sup>4</sup> criteria.]

#### Testing Problems and Special Considerations

Some of the designers and manufacturers of negative pressure filtration units have not put much thought or effort into creating units with “integrity testing” in mind. Not only do they unintentionally design-in leaks, they also often

overlook the inclusion of features that allow access to areas that are critical for leakage testing. Access to the downstream face of the HEPA filter for the purpose of scanning is virtually impossible in most units where the blower is downstream of the HEPA filter. A mixing chamber with baffles is necessary at the inlet of this type of unit to provide adequate mixing. Downstream measurements of the exhaust air stream can be subject to error due to channeling—the opposite of mixing. The aerosol from a specific leak may simply remain concentrated in a segment of the exhaust air stream. Therefore, sampling must be done at various points across the face of the exhaust air outlet, in effect a “scanning” of the opening. A single-point sample is usually not representative of what is in the exhaust air stream. The same considerations are included in making air velocity measurements across the exhaust opening or duct in accordance with ANSI/ASTM 41-2.<sup>16</sup> A single-point reading is not representative.

## 6.6 REFERENCES

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